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U. S. DEPARTMENT OF AGRICULTURE.

BUREAU OF SOILS—MILTON WHITNEY, Chief.

SOIL SURVEY OF THE SAN JOSE AREA, CALIFORNIA.

BY

MACY H. LAPHAM.

[Advance Sheets—Field Operations of the Bureau of Soils, 1903.]

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1904.

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[PUBLIC RESOLUTION—No. 9.]

JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, be amended by striking out all after the resolving clause and inserting in lieu thereof the following:

That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for the use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided*, That in addition to the number of copies above provided for there shall be printed, as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets, bound in paper covers, of which five hundred copies shall be for the use of each Senator from the State, two thousand copies for the use of each Representative for the Congressional district or districts in which the survey is made, and one thousand copies for the use of the Department of Agriculture.

Approved, March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized into the Bureau of Soils.]

MICROFILM AVAILABLE

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MAP.

Soil map, San Jose sheet, California.

SOIL SURVEY OF THE SAN JOSE AREA, CALIFORNIA.

By MACY H. LAPHAM.

LOCATION AND BOUNDARIES OF THE AREA.

The area covered by this report lies in western central California. It occupies the northern part of the depression extending in a southeasterly direction from the southernmost extremity of San Francisco

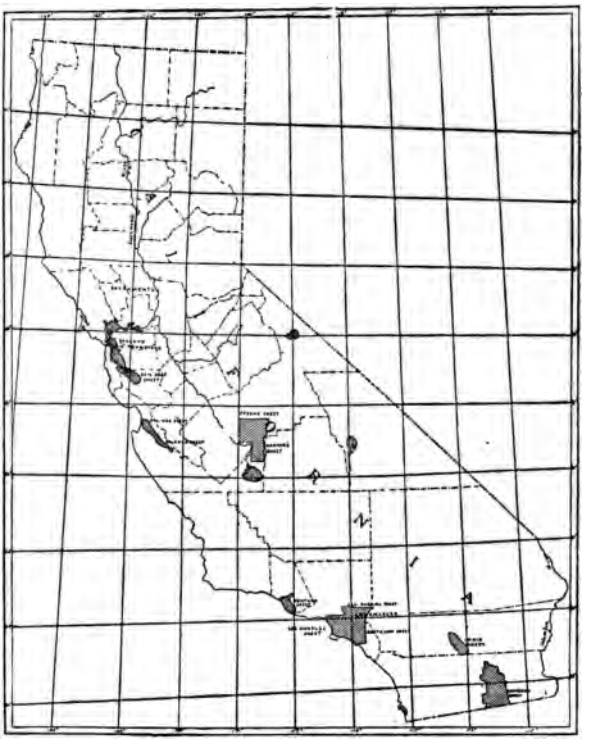

FIG. 1.—Sketch map showing position of the San Jose area, California.

Bay and known as the Santa Clara Valley. This valley is one of the largest of the several coast valleys, and is of great economic importance to the State. It should not be confused with the smaller Santa Clara Valley of southern California bordering the Santa Clara River in Ventura County.

The fertile soil, favorable climate, and fortunate location in regard to markets and facilities for transportation have rendered this section one of the most important horticultural and agricultural districts of the Pacific coast.

In the survey of this area the topographic sheets of the United States Geological Survey were taken as a base map. The area surveyed covers the valley lands of the two sheets designated as the Palo-alto and the San Jose quadrangles. Along the sides of the valley the work is extended to cover the lower foothills and the mountain slopes, but rarely reaches above the 500-foot contour line. From north to south the area includes lands lying within a line drawn directly east and west about 1 mile north of Redwood City to a similar line about 1 mile south of Edenvale. The area included within these boundaries embraces about 315 square miles, covering a large proportion of the famous fruit lands of Santa Clara County, adjacent to San Jose and to other important shipping points.

The northern portion of the sheet includes a large area of swamp land adjacent to the southern extremity of San Francisco Bay, with important fruit, grain, and hay growing sections of the counties of San Mateo and Alameda upon the west and east.

In addition to the construction of the soil map the work included the examination of soils for alkali. Considerable work was also done in examining the waters of wells used for irrigation purposes.

HISTORY OF SETTLEMENT AND AGRICULTURAL DEVELOPMENT.

The introduction to the history of this region is found in the annals of the discoveries and conquests of the Mission Fathers. As early as 1769 a party of Spanish missionaries and soldiers had set out from the Mission at San Diego in exploration of the coast northward. The main object of the search was, it is said, the discovery of a natural harbor in which the ships supplying the missions might safely rest.

In the fall of the year the band under the leadership of one Gaspar de Portola, crossing the Santa Cruz Mountains, discovered and named the Bay of San Francisco and the Valley of Santa Clara. Being impressed with the favorable location of the bay and the natural resources of the valley, the party returned to San Diego.

The interval between 1771 and 1776 was a period of great activity in the extension of the missions along the coast, and it was at this period that the Mission of Santa Clara was established upon the site of the present city of Santa Clara. Some twenty years later saw the founding of the Mission of San Jose, about 15 miles northeast of the present site of the city of that name. Of the latter mission but little now remains.

In their work of conquest and conversion, the lives of these forerunners of civilization present heroic examples of privation, hardship,

persistency, and sacred devotion to cause. With them came the followers—Mexican peons, soldiers, and converts from the native Indian tribes. Game, consisting of deer, antelope, elk, quail, and ducks, was abundant, and fish swarmed in the mountain streams, contributing no little to the food supply. With the conversion of the native tribes to the faith and their concentration about the mission walls, the practice of agriculture received its first impetus. Patches of grain and vegetables were sown, and cattle and sheep were introduced and grazed upon the native grasses. Small pueblos or adobe villages slowly grew up around the missions. That of San Jose de Guadalupe was tributary to the Mission of Santa Clara, and was the forerunner of the city of San Jose. Between the two stretched the Alameda, now a beautiful avenue lined with residences and traversed by an electric railway, then marked by lines of massive oaks, its 3-mile course swept clean daily by the brooms of the mission Indians. The fig, grape, and olive were introduced and grew luxuriantly, the same varieties, especially in the case of the latter fruit, prevailing to the present time as standard stock in California.

The winning of California in the war with Mexico in 1846 and the subsequent discovery of gold brought the Americans. The rush of 1849 filled the country with gold seekers. Some found their way into the valleys, disappointed in their search for gold or recognizing a more certain if less rapid means to wealth in the supplying of hay, grain, and vegetables to the mining camps. The number of farms increased. Dwellings, stores, and other business buildings sprang up. The adobe pueblos gave way to bustling towns, and the mission walls, with the pastoral system of the padres, crumbled into decay. Mission Santa Clara, however, became the seat of Santa Clara College, founded by the Jesuits in 1851.

Much of the land was for a time held in the large grants made to private individuals by the Crown of Spain and honored by the United States upon the accession of the territory. The transition of the original rancho and the extensive grain and stock farm to the small tract devoted to fruit growing and other specialized industries is the natural outgrowth of favorable climate, progressive citizens, and advantageous position as regards markets and transportation.

CLIMATE.

The climate of the Santa Clara Valley is semiarid. It is characterized by a wet and a dry season, with moderate or slight rainfall during the latter, absence of excessively high or low temperatures, gentle and steady wind movement, low relative humidity, total absence of snow, and frequent occurrence of fog. These conditions prevail largely as the result of topographic features.

Both the hot winds from the heated stretches of the Great Valley

of California and the damp, chilling blasts of the ocean are deflected by mountain barriers. Through the summer the days are warm, but the temperature rarely greatly exceeds 90°. The average summer temperature is 68°, and for winter about 40°. The nights are always cool, the daily variation in temperature being considerable.

Except in the case of late frosts occurring along depressions, buds and young fruits are rarely injured. Conditions of temperature favorable to the growth of native range grasses, as well as of the forage crops of the farm, extend throughout the year. Stock needs but little protection from the elements aside from housing from the severest of the winter rains. The blossom season of the fruits extends from late in January into May. Snow is unknown, except upon the mountain tops. The cold air, by reason of its greater weight, settles to the lower valley levels and depressions. This explains the inability to grow peaches, apricots, prunes, and all but the hardiest fruits in certain local sinks and depressions, notably along the axis of a depression extending in a northwesterly and southeasterly direction, and lying midway between San Jose and the mountains directly east. Upon lands of equal or less elevation, but bordering the bay, the frosts are less severe, the air being somewhat tempered by proximity to the open water, which in a measure prevents sudden extremes. In contrast to these areas are the lands of higher elevation, extending along the foothills of the mountain slopes and lying within what is known as the Thermal Belt. Here the citrus and the less hardy deciduous fruits may be grown with but little danger of damage by frosts.

The average annual rainfall in the valley is about 15 inches. It increases rapidly with the elevation, reaching 30 inches or over in the foothills of the surrounding mountains. From May to November there is rarely any precipitation of importance. Throughout the summer the grain harvesting, thrashing, and fruit picking and drying processes go on without interruption. The late fall, winter, and early spring months—the rainy season—are marked by frequent gentle showers. Violent storms, cloud-bursts, and thunderstorms are of very rare occurrence or unknown. Several days of clear, warm weather often intervene between the showers. A large proportion of the precipitation thus finds its way slowly into the soil, to be stored in the soil recesses and made available for future crops. A table giving data upon the temperature and rainfall of the area follows.

Normal monthly and annual temperature and precipitation.

Month.	Gilroy.		Lick Observatory.		San Jose.	
	Temperature.	Precipitation.	Temperature.	Precipitation.	Temperature.	Precipitation.
	° *F.*	*Inches.*	° *F.*	*Inches.*	° *F.*	*Inches.*
January	46.3	4.71	38.4	4.93	48.0	2.80
February	49.2	3.08	39.7	4.81	50.6	2.30
March	53.8	2.89	40.4	4.90	53.6	2.57
April	57.9	1.74	46.0	3.39	61.4	1.38
May	62.7	.71	52.4	1.72	60.2	.56
June	67.0	.09	59.9	.52	65.4	.14
July	69.0	.00	68.5	.00	66.7	.00
August	68.1	.05	70.4	.05	66.5	.03
September	65.7	.18	61.7	.38	64.8	.21
October	60.3	1.08	54.0	1.63	60.2	.80
November	52.6	1.97	49.5	2.71	54.0	1.34
December	47.9	3.42	41.6	7.51	50.2	2.75
Year	58.4	19.92	51.9	32.55	58.5	14.88

A condition of low relative humidity usually prevails. This is, however, much less marked than in the great interior valley lying between the Sierras and the Coast Range. Hay and fruit crops cure quickly, and during the summer months the heat is much less oppressive than would be the case were the condition of the air less dry.

The movement of the air is controlled largely by the trade winds. These enter by way of the Golden Gate, cross the waters of the bay, are deflected by the mountain ranges, and traverse the valley as gentle, steady breezes, gradually losing moisture with their progress inland. During the dry season they are very regular in character, increasing in force during the day and reaching a maximum during the middle or later afternoon. In the vicinity of the bay their force is great enough to leave its imprint upon the native trees, which incline slightly toward the southeast. They are rarely violent or destructive to growing crops, and furnish cheap and regular motive power for pumping water for stock and for irrigation upon a small scale.

During the dry season clouds are rarely seen. The rainy season is marked by the frequent occurrence of clouds interspersed with periods of sunshine and fair weather. The number of cloudy days during the year 1901 was 80. Fogs are of frequent occurrence, usually appearing during the night and early morning of the summer months. They are usually soon dissipated by the morning sun, and are much less frequent and pronounced in character than in the near vicinity of the Golden Gate.

As a whole the climate is pleasant, healthful, and highly favorable to horticultural and agricultural pursuits.

PHYSIOGRAPHY AND GEOLOGY.

From the Bay of San Francisco the Santa Clara Valley stretches southeastward throughout the portion surveyed as a nearly level plain from 15 to 20 miles in width. A short distance above the survey boundary upon the south, ranges of hills, extending outward from each side, greatly constrict the valley. From this point it soon expands again and continues in a southeasterly direction until it gradually narrows to a point and disappears in the passes of the Santa Cruz, Gabilan, and Mount Diablo ranges in the vicinity of Tres Pinos, in San Benito County, some 60 miles from the bay.

Although apparently level, a gradual slope maintains from the valley trough outward to the mountain bases upon each side. The whole system also slopes slightly in the direction of the Bay. With the approach of the valley walls the degree of slope is gradually increased. Alluvial fans, mountain foot slopes, and débris aprons, which are in places interrupted by recent faulting, erosion, or upheaval, extend outward and downward in symmetrical form to the valley.

The western boundary of the valley is formed by the Santa Cruz Mountains, while upon the east extend the ridges of the Mount Diablo Range. This is one of the most extensive ranges of the California coast, reaching from Mount Diablo, in the vicinity of Oakland, southward and parallel with the coast for 300 miles.

A considerable proportion of the northern part of the area surveyed is taken up by marsh lands adjacent to the Bay of San Francisco. Through these meander a great number of small sloughs, the remnants of former stream channels.

The valley floor is smooth and, with the exception of a few localities adjacent to present main stream channels, unmarked by terrace lines or rock outcrops. The stream channels are frequently bordered by a moderately heavy growth of willows, sycamores, and other common shrubs and trees of the region. Liveoaks of picturesque outline and massive proportions often dot the mountain foot slopes, alluvial cones, and valley floor. Unlike most of the larger coast valleys, no large trunk stream exists. The valley is drained by a number of small streams, each of which, rising in the adjacent mountains, hurries its waters into the bay by the most direct route. Only two of these streams, the Guadalupe and Coyote creeks, are perennial, and in these there is but little surface flow during the dry season. The latter rises in the hills of the upper valley and empties into the main estuary of San Francisco Bay. The former, and the smaller of the two, finds its way to tide water through Alviso Slough. Other streams of the area are dry throughout their courses across the valley during the summer months, and although there is a considerable flow of water through all these streams during the rainy season, the supply is too

slight in amount and periodical in character to furnish more than a few favorably situated farms and ranches with water for irrigation purposes. Except in the vicinity of the bay, the beds of these streams are often cut deep below the level of the surrounding country, with perpendicular sides and narrow, flat bottoms covered with cobbles, river sands, and gravels. This indicates the relative newness of the formation of the valley or the occurrence of recent uplifts of the land surface.

The slopes of the surrounding mountains are usually smooth in outline, exhibiting an advanced stage of degradation, and are often capable of cultivation nearly to their summits. This is attended with difficulty, but the value of such lands when planted to orchards and vineyards has made their use, where practicable, quite profitable. This is true especially of the Mount Diablo Range of the eastern side. In the vicinity of streams, however, canyons and precipitous slopes often occur.

The elevation of nearly all the towns of the area is less than 100 feet, while the maximum elevation of the mountains immediately adjacent to the area rarely exceeds 2,500 feet. Farther back in the ranges this height is greatly exceeded. Bowlders and outcrops of rock frequently occur upon the foothills and mountain slopes. Liveoak and other native trees border the ravines and canyons of the Mount Diablo Range. Upon the summits of the Santa Cruz the giant redwood is conspicuous. Occasionally it finds its way along the slopes and into the valley, but only as isolated specimens. This range throughout is much more heavily forested than the mountains on the east side of the valley.

The rocks of the Santa Cruz and Mount Diablo ranges and foothills are remarkable for their variety and complexity of structure, texture, and mode of occurrence. Gneiss, schists, limestones, marble, and granites make up a large proportion of the ancient crystalline and metamorphic rocks of uncertain age. Slates, shales, jasper, serpentine, conglomerates, and sandstones are also common. Basalt occurs upon some of the foothills bordering the northwestern part of the area, giving rise to an adobe soil. Siliceous shales of the Monterey series and beds of volcanic ash occur in the Santa Cruz Range. Ancient eruptives occur intimately associated with sedimentary and metamorphic rocks of later date. The rocks encountered within the boundaries of the area surveyed consist mostly of granites, altered granites in various stages of decomposition, conglomerates, and sandstones. The last-named rocks occur upon the higher elevations of the west side foothills, giving rise to a light-gray or drab sandy loam containing a relatively large amount of white or drab sand of medium texture. The rocks of the granite series weather into dark-colored sandy loams and gray sandy adobes.

The valley itself is a great synclinal fold. Where the underlying beds emerge at the mountain bases many secondary folds, flexures, and faults occur. This has resulted in greater complication of the original rock structure. Quarries of crystalline limestone and building stone of excellent quality occur. The disintegrated granites are useful for road building, while valuable mineral deposits, especially quicksilver, are profitably mined.

Gravel beds are sometimes exposed along the margins of the valley plain and the adjoining foothills. Disintegration of the rocks of the lower slopes of the Mount Diablo Range usually produces an adobe soil. Springs along this formation are often charged with alkali salts and other minerals. The material of the intermediate and upper valley slopes consists largely of mountain waste distributed by minor canyon streams.

The axis of the valley is occupied by alluvial deposits from the two main drainage streams. The lower valley is filled to great depths with the finer alluvial sediments and lacustrine deposits which merge into the present muds of the tidal marshes about the bay.

These deposits blend gradually into each other, rendering the placing of the soil boundaries more or less arbitrary.

SOILS.

The extent and position of the various soil types are shown upon the soil map accompanying this report. The occurrence of gravel in such quantities as to influence soil texture, structure, and cropping is indicated by the proper symbol. The soil map is published upon the scale of the original base map, in which 1 inch represents very nearly 1 mile. Upon the map margins is given the legend scheme of the map and also the soil profile exhibiting the structure of the soil types to a depth of 6 feet. In general, owing to the indefinite boundaries and variation of the soil types, the results can not be interpreted as closely in this area as could otherwise be expected.

The soils of the San Jose area fall into three natural divisions according to origin and mode of occurrence, viz, those of mixed residual and colluvial deposits, or derived from mountain waste; alluvial soils, and soils derived from lacustrine deposits. The residual soils are formed by decomposition of rock in place, and occupy, with perhaps slight changes, the position of the original rock. The colluvial soils are made up of the coarser particles of the waste of the mountain sides, transported by mountain torrents, temporary streams, or heavy rainfall, and occupy the mountain footslopes and upper valley levels. The alluvial soils occupy mainly the lower levels of the valley adjacent to the main stream channels, and are due to the deposition of the finer sediments by the streams. The lacustrine deposits occupy the lower portion of the valley adjacent to San Francisco Bay, and originated

with the slow deposition of clay and the finer silt particles in the slack waters of the bay and its system of tidal sloughs and marshes.

The following table gives the extent of each of the soil types mapped:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Placentia sandy loam	61,568	30.8	Arroyo Seco sandy loam	7,616	3.8
Salinas gray adobe	39,232	19.4	Fresno fine sandy loam	5,184	2.6
San Joaquin black adobe	30,400	15.2	Oxnard loam	4,224	2.1
Galveston clay	26,048	13.0	Riverwash	128	.1
Oxnard silt loam	25,920	13.0	Total	200,320	

ARROYO SECO SANDY LOAM.

The Arroyo Seco sandy loam is a very light, loose, gravelly loam, usually 6 or more feet in depth, containing a large proportion of coarse and medium sand. The soil particles are well abraded, but rather sharp. The gravel occurs in large and often excessive amounts, the fragments consisting generally of flattened but well-worn particles of granite, schist, gneiss, and other rocks. Sharp, angular fragments sometimes appear. The soil is here and there underlain at depths of less than 6 feet by gravel beds and river sands.

In extent of area this soil type is one of the least important of the valley. It occurs in a few bodies of irregular outline lying along the southern boundary of the area and interrupted by the adjoining soil types. One small body also occurs between the towns of Santa Clara and Mountainview.

The Arroyo Seco sandy loam occupies the intermediate or upper slopes of the valley, or extends as narrow bodies along present or former channels of mountain streams of intermittent character. The surface is level or only slightly rolling, and is devoid of physiographic variety, except for occasional cuts or stream erosions. The soil and subsoil are extremely loose, porous, and well drained; the water table is far below the surface, the soil dries out quickly, and free and copious irrigation is necessary for most crops.

This soil originates with the disintegrated granites and allied rocks of the surrounding mountains. It is usually deposited near the base of the abrupt slopes, or along natural drainage channels of considerable fall, as the coarser or first product of waste-laden flood streams and mountain torrents. It grades into the Placentia sandy loam which usually accompanies it. This soil contains but a small proportion of the finer mineral matter, is of moderate productiveness, and is free from alkali salts.

Apricots, peaches, prunes, plums, almonds, olives, and other stone fruits are grown to some extent upon this soil with moderate yields.

Small areas are also devoted to the growing of hay and grain. The larger part of the type is, however, devoted to vineyards, the chief product being wine grapes.

As this soil yields but a meager return when devoted to grains or other crops taxing the organic and mineral resources of the land, it should not be used for such crops. It is best adapted to grapes, early peaches, and the lighter stone fruits.

The mechanical composition of the fine earth of this soil is shown by the following table:

Mechanical analysis of Arroyo Seco sandy loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
8868	5 miles S. of San Jose.	Light sandy loam, 0 to 12 inches.	1.15	9.46	13.94	7.62	13.44	13.30	26.52	15.40

PLACENTIA SANDY LOAM.

The Placentia sandy loam is, in typical section, a brownish or reddish-yellow sandy loam, containing an appreciable amount of rather coarse, sharp sand, often gravelly, 3 feet in depth, underlain by sandy adobe. The soil is rather compact, often breaking into clods, passes gradually into the underlying adobe, and cracks sometimes on the surface. It is, however, subject to great variation in texture, structure, and profile. Gravel frequently but not always occurs, ranging from fine angular chips and fragments to large, well-rounded pebbles. In the latter case the soil generally extends to a greater depth than 3 feet and loses its compact nature, while the percentage of coarse sand and gravel is increased.

Both in point of extent of area covered and in agricultural importance this soil type is one of the most important recognized in the survey. The bodies are large, and except when cut by areas of less extensive types, extend from the base of the valley walls to the alluvial soils of the valley trough. Narrow bodies and small patches also occur along stream channels and at irregular intervals throughout the valley. Along the middle and lower slopes of the valley the lighter phases of the soil usually occur, while covering the higher elevations of the foothills bordering the northwestern portion of the area the soil assumes a lighter color and contains a large proportion of loose sand of light color and medium texture.

Upon the valley floor the surface is level or inclined slightly in the direction of the valley trough. Along the mountain slopes and foothills, which it frequently covers, the slopes become much accentuated and often quite abrupt. Ravines and deep-cut stream channels, with occasional smooth and relatively broad valleys, give variety to the surface. Rock outcrops occur only along canyon streams and upon a few abrupt and eroded slopes of the foothills and mountain bases.

The Placentia sandy loam is in most cases well drained. Except in the case of some of the lighter phases, however, it retains moisture exceedingly well if properly cultivated.

In origin and processes of formation this soil is, for the most part, similar to the Arroyo Seco sandy loam, the material being finer and hence carried to a greater distance along the slope of the mountains and the alluvial fans extending outward from canyon mouths. In higher elevations along the valley borders and foothills it is partly residual in origin, the material having been produced largely by weathering of the rocks in place.

While the lighter phases of this soil are not of marked productiveness, the Placentia sandy loam is, for the most part, capable of producing excellent crops under proper systems of cultivation. The heavier phases, resulting from an admixture of the adjoining heavier and alluvial soil types, better endure persistent cropping and severe droughts. With the exception of very few localities bordering lower lying and heavier types, no alkali salts in dangerous quantities are present.

The Placentia sandy loam is devoted mainly to the growing of prunes, peaches, apricots, wine grapes, cherries, barley for grain and hay, small fruits, and vegetables. Under thorough and careful systems of rotation, manuring, irrigation, and cultivation excellent yields of all these crops are produced.

The lighter phases are best adapted to grapes and stone fruits requiring a light early soil. The heavier phases are adapted to prunes, apples, pears, peaches, apricots, olives, cherries, etc., and also to grain, hay, and vegetables.

The table following shows the results of mechanical analyses of the fine earth of this soil type.

Mechanical analyses of Placentia sandy loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
8888	4 miles S. of San Jose	Sandy loam, 0 to 12 inches.	1.73	1.28	5.26	6.00	28.30	19.96	27.12	12.04
8891	Paloalto	Fine sandy loam, 0 to 12 inches.	2.13	.00	.10	.40	7.30	24.10	52.48	15.54
8892	Subsoil of 8891	Fine sandy loam, 12 to 72 inches.	1.19	.08	.30	.40	8.48	26.54	53.26	10.24
8889	Subsoil of 8888	Coarse sandy loam, 12 to 36 inches.	.61	.82	4.16	6.12	30.40	19.04	26.10	13.36

OXNARD LOAM.

The Oxnard loam is a dark-brown or black loam, sticky when wet, but usually containing considerable medium and coarse sand. It is generally 6 feet in depth, becoming more compact in the lower part of the section. A relatively large proportion of well-rounded granitic pebbles and small gravel usually occurs in this soil type.

Owing to the small area covered, this is one of the least important types of the valley. Only a few small bodies of irregular outline occur, and these are scattered in patches in the southern and central portions of the area surveyed. The soil grades into the Placentia sandy loam and the San Joaquin black adobe, between which it forms an intermediate type.

It occupies nearly level or slightly depressed parts of the valley, often bordering the low-lying soils of lacustrine and alluvial origin. It is without marked physiographic feature, except for occasional washes and the courses of intermittent streams. As a rule the soil is rather loose and well drained. In certain local areas adjacent to the heavy soils of the lower valley floor, however, the water table lies close to the surface and the soil is somewhat more compact, rendering artificial drainage beneficial.

The Oxnard loam is probably a mixture of the lighter soils derived from mountain waste with the heavier alluvial and lacustrine deposits of the valley depressions.

An abundance of organic matter enriches this soil and it is very productive. Alkali salts are present in appreciable quantities only in a few instances in low, poorly drained areas. In the vicinity of Lawrence the subsoil contains deposits of a whitish material, rich in lime carbonate and gypsum and closely resembling marl.

This soil is best adapted to grapes, stone and other deciduous fruits,

strawberries, raspberries, tomatoes, onions, and vegetables. It is at present used chiefly for the production of staple fruits, as well as for grain, hay, onions, and vegetables, of which excellent yields are secured.

The following table gives mechanical analyses of typical samples of the fine earth of this soil:

Mechanical analyses of Oxnard loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
8880	5 miles S. of San Jose.	Heavy brown loam, 0 to 12 inches.	2.19	0.42	2.30	1.58	7.14	17.58	42.66	28.24
8882	3 miles NW. of Santa Clara.	Black loam, 0 to 36 inches.	2.09	1.44	2.80	3.04	11.10	12.98	28.24	40.10
8883	Subsoil of 8882.....	Gray loam, 36 to 72 inches.	.20	3.80	4.30	2.68	10.50	13.68	33.84	30.98
8881	Subsoil of 8880.....	Heavy loam, 12 to 72 inches.	1.25	.28	1.52	1.48	6.70	17.18	41.82	31.00

The following samples contained more than one-half per cent of calcium carbonate ($CaCO_3$): No. 8882, 16.99 per cent; No. 8883, 33.67 per cent.

SALINAS GRAY ADOBE.

The Salinas gray adobe, like the Oxnard loam, partakes much of the characteristics of the heavy alluvial and lacustrine deposits. It is subject to considerable variation in color, texture, structure, depth, and position in relation to topographic features. Typically this soil consists of a dark gray to nearly black adobe of fine sandy to silty texture, becoming very sticky when wet, and during the dry season baking and cracking badly. Upon the foothills and mountain bases it is often 10 or 12 inches in depth, underlain by disintegrating granite. Throughout the valley parts of the area, however, the depth of the soil usually reaches 6 or more feet. The lighter phases grade into the Placentia sandy loam, while the heavier phases gradually merge into the San Joaquin black adobe. Gravel is frequently present in areas upon the foothills and higher slopes, ranging in character from fine and angular chips to small rounded pebbles of granite, schist, gneiss, and old eruptives. In certain parts of the area the percentage of fine gravel is very marked, and the soil approaches very closely the typical sandy adobes. This phase will be treated separately.

The Salinas gray adobe usually occurs as rather small, narrow, and irregular bodies throughout the valley—frequently extending over

the higher elevations and foothills along the northwestern and southeastern parts of the area surveyed. The valley areas are generally smooth and nearly level. Along the foothills and mountain slopes the surface is rolling, sometimes with abrupt slopes and frequently broken by ravines and eroded stream courses and by outcrops of granite and eruptives upon higher portions. These outcrops are marked in case of the low hills lying in the extreme southeastern portion of the sheet.

Along the valley margins and in foothill areas this soil is usually well drained, the water table lying far beneath the surface. The only exception to this is found in areas around a few springs reaching the surface in the higher levels. Rains falling upon the land readily soak into the subsoils through the systems of checks and cracks which give the soil a loose structure. When properly cultivated the soil breaks into a loose, coarse mulch, retaining the moisture stored in the subsoils for long periods of time. Lower bodies lying in the valley depressions and adjacent to the heavy, wet soils of the lower valley trough and the tidal marshes are of a more close, compact, tenacious character. The water table here lies close to the surface and artificial drainage becomes necessary.

Upon the higher elevations this soil is largely residual, resulting from the disintegration of underlying granite. In local depressions, drainage channels, and lower slopes of the valley an admixture of the finer products of mountain waste and alluvial material has taken place, which, with further weathering, has resulted in a more compact, more tenacious soil of finer texture.

This soil is usually well supplied with organic matter and is very productive. Alkali salts are often present, but only occasionally in dangerous quantities, and then only in poorly drained areas.

All kinds of stone and other deciduous fruits of the section, as well as grapes, grain and hay, onions, and occasionally other vegetables, are grown, and, if well cultivated, the yields are heavy. Upon the areas of the higher slopes the soil is best adapted to apricots, prunes, peaches, grapes, grain, and hay. Intermediate and lower slopes are best adapted to the hardier fruits, sugar beets, onions, grain, and hay.

The sandy phase of the Salinas gray adobe is a dark-brown, coarse, sandy adobe bearing considerable fine angular gravel, from a few inches to 6 feet or more in depth, and underlain by disintegrated and decomposing granite rock.

This phase occupies parts of the upper slopes of the valley border and the lower mountain bases and foothills in the western and northwestern parts of the area. The slopes are generally smooth and gently rolling, although sometimes quite abrupt, the physiographic features being similar to those of the typical Salinas gray adobe.

During the dry season the soil cracks deeply, the immediate surface being converted into a loose, coarse mulch of irregularly shaped soil pellets, which greatly augments the moisture-retaining properties of the soil. Good natural drainage exists, and the soil is free from alkali salts in dangerous quantities.

The sandy phase of the Salinas gray adobe originates with the disintegration of the rocks of this part of the area. Slight modification by admixture of alluvial material from stream and rain wash has frequently taken place.

This soil, although carrying less organic matter than the typical adobes of the valley bottoms, is quite productive.

It is generally devoted to the growing of grain, hay, and fruit, to which it is well adapted, the yields being large.

The results of mechanical analyses of samples of the fine earth of the Salinas gray adobe are given in the following table:

Mechanical analyses of Salinas gray adobe.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
8897	Hillsdale.....	Gray loam, 0 to 12 inches.	2.63	4.10	8.92	4.72	10.56	11.88	40.86	18.92
8893	1 mile N. of Fair Oaks.	Gray clay loam, 0 to 12 inches.	1.81	1.04	2.10	1.20	4.62	13.46	44.78	32.80
8895	3 miles NE. of Milpitas.	Brown loam, 0 to 36 inches.	.57	1.18	2.48	2.30	10.64	10.54	36.02	36.78
8894	Subsoil of 8893.....	Gray clay loam, 12 to 48 inches.	1.73	1.02	1.84	1.04	5.46	14.68	44.90	30.98
8896	Subsoil of 8895.....	Loam, 36 to 72 inches.	.46	1.34	2.68	2.26	9.84	9.72	33.88	40.28

RIVERWASH.

The Riverwash consists of coarse river sands, waterworn pebbles, and small rounded bowlders. It occurs as a single, small, narrow body extending southward from the town of Campbell for a short distance. It occupies the bed of Los Gatos Creek, the creek bed being here somewhat widened by erosion. It lies some distance below the surrounding country, from which it is separated by small, low bluffs. The surface is somewhat uneven, being strewn with cobbles and barren of vegetation.

During the summer months there is little or no water in this part of the stream; in periods of flood, during rainy seasons, however, it overflows the entire area of this soil.

The Riverwash consists of the coarser material derived from mountain waste. It appears along stream beds of considerable fall, being pushed along the bottom or deposited from débris-laden waters during periods of unusual flood. Owing to its texture and position it is of no agricultural value.

FRESNO FINE SANDY LOAM.

The Fresno fine sandy loam is a light-yellowish sandy loam of fine, smooth texture, usually 6 feet or more in depth, generally underlain by coarser sands. Sometimes the sand is encountered at a depth of less than 6 feet. The soil is only slightly sticky when wet. Upon drying it exhibits a somewhat firm, chalky structure, which is easily changed into a loose, pulverulent condition by cultivation.

The proportion of the area mapped covered by this soil type is small. It occurs only in long, narrow bodies bordering Coyote and Guadalupe creeks and the lower part of Campbell Creek. The soil is generally free from gravel and gradually merges into the heavier silt loam of the valley bottoms.

The surface is generally smooth, level, or very slightly rolling, but is occasionally marked by low terraces cut by the streams. Stream courses are often cut deeply through this formation, the soil eroding in nearly perpendicular walls. In sections thus exposed, irregular beds of coarse river sands and gravels appear, underlying the finer materials at the surface. A considerable growth of willows, sycamore, and other trees and shrubs usually found bordering streams in this section frequently occurs. In all except some small areas of this soil type lying in lower valley levels and near the marsh lands of San Francisco Bay, the water table lies far below the surface, while the soil is of a light, loose nature, and well drained.

The soil owes its formation to the deposition of the finer sands, with a certain admixture of silts, from the flood waters of the valley streams.

This soil frequently contains a large amount of micaceous material, imparting to it a somewhat open structure. Water is absorbed readily and, with the aid of frequent cultivation, preserved in the subsoil for long periods of time. Alkali salts in injurious quantities are present only in the lower lying areas where drainage is deficient.

The Fresno fine sandy loam is generally devoted to the growing of prunes, apricots, cherries, and other fruits of the valley, with excellent yields. Vegetables, strawberries, raspberries, and other small fruits are raised to some extent and with considerable profit. In the lower part of the valley large areas of asparagus are produced.

This soil, when well drained and free from alkali, is well adapted to the crops now grown.

A table showing the mechanical composition of this soil is given below:

Mechanical analyses of Fresno fine sandy loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
8872	2½ miles S. of San Jose.	Yellow fine sandy loam, 0 to 12 inches.	1.73	0.10	0.32	0.44	6.26	22.44	57.88	12.56
8869	2½ miles SE. of San Jose.	Yellow fine sandy loam, 0 to 12 inches.	2.49	.04	1.86	.38	4.84	23.80	53.74	15.20
8873	Subsoil of 8872.....	Fine sandy loam, 12 to 36 inches.	.13	.24	.60	.70	33.20	27.32	27.30	10.64
8870	Subsoil of 8869.....	Fine sandy loam, 12 to 42 inches.	2.27	.04	.16	.30	4.98	24.96	54.92	14.60

The following sample contained more than one-half per cent of calcium carbonate ($CaCO_3$): No. 8873, 1.55 per cent.

OXNARD SILT LOAM.

The Oxnard silt loam is a very fine, heavy silt loam of brownish color, 6 feet or more in depth. Normally it is of a close, dense structure, but is easily broken up by cultivation into a fine, friable loam. It is very sticky when wet, puddles readily, and bakes hard, resembling in its heavier phases the true adobes, into which it frequently grades. Lighter phases bordering the sandy loams frequently carry considerable sand of the medium and finer grades. Gravel rarely occurs in sufficient quantities to influence the soil structure.

Small bodies of this soil, of irregular outline, frequently occur between the valley bottoms and mountain bases. The largest areas, however, extend parallel to the two main stream channels throughout the valley trough. In extent of area covered and agricultural importance the type is one of the important soils of the San Jose area.

This soil occurs in level or slightly depressed parts of the valley floor. The surface is generally smooth, and broken only by minor stream channels and incipient washes. Poorly drained areas are frequently covered by a thick growth of salt grass, alkali vegetation, and other native grasses and weeds.

The Oxnard silt loam is of a very tenacious character and when allowed to bake assumes an extremely hard and refractory structure. Proper cultivation, however, alleviates or entirely prevents this condition. With the exception of a small area lying east of San Jose and larger bodies lying between San Jose and the bay, the soil is generally

well drained. In these low-lying areas, however, the water table lies near the surface, and cultivation is attended with considerable difficulty. Large areas are devoted to pasture or the production of crops in which tillage plays a minor part. The surface frequently becomes very compact and hard, and cracks similar to those exhibited in the adobe soils appear. The subsoils are very dense and heavy and natural drainage is greatly retarded.

This soil closely resembles the Fresno fine sandy loam in origin and in the processes of formation, the material being finer and having been deposited from slack water in flood plains of streams. Considerable addition has in places been made by the wash of the finer particles from the surrounding soil bodies and mountain slopes.

When properly cultivated, the rains of the wet season find their way readily into the subsoil of this type and are there retained throughout long periods of drought. This property admits of the storing of large quantities of moisture, which is returned to the soil surface by the pronounced capillary powers of the soil. With the natural productiveness of the type this renders it of great agricultural value. Injurious alkali salts exist in considerable quantities in areas of deficient drainage.

Large yields of fruits, consisting of prunes, apricots, cherries, apples, etc., and of vegetables, small fruits, asparagus, grain, and hay are produced on this soil type. Of these crops this soil is best adapted to apricots, prunes, vegetables, and small fruits, and other fruits requiring a fine-textured, productive soil. The lower lying areas of deficient drainage and slight alkali content are adapted to pasture lands, grain, and hay, while the lighter phases prove excellent producers of asparagus, which is grown commercially.

The results of mechanical analyses are given in the following table:

Mechanical analyses of Orchard silt loam.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.	P. ct.
8884	2 miles SE. of San Jose.	Brown silty loam, 0 to 12 inches.	0.92	0.14	0.42	0.40	4.24	14.76	58.78	21.16
8886	2 miles N. of San Jose.	Brown silty loam, 0 to 36 inches.	1.48	.10	.70	1.24	4.90	8.42	55.64	28.22
8885	Subsoil of 8884.....	Silty loam, 12 to 72 inches.	.43	.02	.40	.40	5.30	16.72	55.32	21.80
8887	Subsoil of 8886.....	Brown silty loam, 36 to 72 inches.	.82	.18	.64	.48	1.36	3.68	60.82	32.68

SAN JOAQUIN BLACK ADOBE.

The San Joaquin black adobe consists of a heavy black clay adobe of very stiff, tenacious texture and refractory structure, usually extending to a depth of 6 feet or more. It is extremely sticky when wet, bakes and cracks deep upon drying, and is difficult to cultivate. However, lighter phases, bordering lighter soil types, occur, in which the heavy dense properties are much less prominent. A small quantity of very fine but sharp sand sometimes occurs but does not greatly influence the soil texture.

This soil generally occupies the lower levels and depressions of the valley floor. Occasionally small bodies occur in the more elevated slopes, or extend into the elevations of foothills and mountain bases along stream channels, and in the vicinity of seepage springs.

The areas in the lower depressions are large and usually quite uniform. The lighter phases grade into the Placentia sandy loam and the Salinas gray adobe; the heavier into the Galveston clay of the marsh lands.

In the larger bodies the surface is that of a level, flat plain without marked physiographic variation; the smaller areas occupy minor depressions and drainage courses or occur as irregular patches along intermediate valley slopes. No gravel areas, terraces, or rock outcrops appear. A scattering growth of native oaks sometimes occurs along borders adjoining areas of lighter soil. The lower lying bodies are frequently covered by a growth of salt grass and weeds, indicating the presence of alkali salts.

Owing to the tenacity of texture, firm structure, and the proximity of the water table to the surface of the soil, the natural drainage over large areas is often deficient, rendering the opening of artificial drainage channels a necessary preliminary to cultivation. The higher areas, although of dense, heavy texture, are generally well drained.

This soil is believed to be largely the product of lacustrine or swamp deposits derived from the slack waters of the tidal flats, sloughs, and estuaries of San Francisco Bay, which at one time evidently extended farther inland than at present. To these sediments has been added a considerable proportion of stream-borne materials and the wash from surrounding soil bodies, while the maceration and decomposition of vegetable products and further weathering of the mineral matter have aided in the formation of the type.

This soil is of marked capillary power and very productive. The subsoil is capable of absorbing and containing large quantities of water, which under a system of deep and thorough cultivation is preserved and delivered gradually to the growing crops. Owing to the dense, heavy character of the soil, and the deficient drainage in the lower and heavier bodies, a small, though sometimes considerable, proportion of the alkali salts is usually present.

In the vicinity of San Jose, Santa Clara, and Mountainview small areas of this soil type are devoted to the growing of apples, pears, prunes, and other staple fruits, the land yielding well when properly drained and cultivated. Other portions of the lighter phases are devoted to the growing of vegetable and flower seeds, consisting chiefly of onions, lettuce, and sweet peas. Strawberries, raspberries, and other small fruits are also widely grown, under thorough cultivation, with excellent yields. The heavier phases of light alkali content produce heavy yields of grain, hay, and sugar beets. Poorly drained areas of heavy alkali content are devoted mainly to pasture and to stock raising.

On the whole the San Joaquin black adobe, in the higher elevations and in the areas of lighter phases, is best adapted to the growing of grains, hay, small fruit, cabbages, onions and other vegetables, and seeds. The most promising crops for the heavier phases consist of barley, wheat, hay, and sugar beets.

The mechanical composition of the soil is shown in the table which follows:

Mechanical analyses of San Joaquin black adobe.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
8901	1½ miles NW. of Santa Clara.	Black loam, 0 to 36 inches.	1.01	0.32	0.98	0.82	3.76	7.30	43.34	43.30
8899	4 miles S. of San Jose.	Black clay loam, 0 to 12 inches.	1.98	.36	.84	.78	3.26	6.16	34.74	53.66
8900	Subsoil of 8899.....	Heavy clay loam, 12 to 72 inches.	.39	.18	.92	1.58	11.42	13.50	36.62	35.66
8902	Subsoil of 8901.....	Drab loam, 36 to 72 inches.	.10	.98	1.74	1.40	6.16	10.78	41.18	37.62

The following samples contained more than one-half per cent of calcium carbonate ($CaCO_3$): No. 8900, 5.15 per cent; No. 8901, 5.43 per cent; No. 8902, 9.89 per cent.

GALVESTON CLAY.

The Galveston clay consists typically of a sticky, silty clay, extending to a depth of 6 feet or more. The immediate surface is generally black in color, soon changing beneath the surface to a brown or yellowish tint, the material sometimes grading quickly into a blue or black mud.

This soil occurs in a single body, covering an area of nearly 50 square miles around the waters of San Francisco Bay. The surface is flat and only a little above mean sea level. Through the area meander the open, tidal sloughs and remnants of former drainage channels, to

which reference has previously been made. The vegetation consists solely of the characteristic salt-loving weeds of coastal marshes.

Over this area the water table may usually be encountered at a depth of less than 3 feet, and over a great part the soil is nearly or completely saturated with salt water. Owing to fineness of texture and density and tenacity of structure, drainage is greatly retarded. This soil can be rendered capable of cultivation only at great cost.

The origin and processes of formation of this soil are similar to those of the San Joaquin black adobe. The processes of drainage, maceration of organic matter, and decomposition of the material in mass are, however, here much less advanced.

This soil contains a large amount of vegetable matter, occurring as partially decomposed fragments of stems and other portions of aquatic plants. A very large quantity, usually exceeding 3 per cent of the dry soil of the marine or alkali salts, also generally occurs in this type.

The Galveston clay, under present conditions of drainage and alkali content, is of no agricultural value.

The following table gives mechanical analyses of this soil:

Mechanical analyses of Galveston clay.

No.	Locality.	Description.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
			P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
8878	Cooley Landing....	Clay, 0 to 12 inches.	6.56	1.42	4.04	3.42	9.00	10.36	26.38	45.38
8876	Alviso.....	Heavy clay, 0 to 12 inches.	7.23	.04	.16	.20	1.38	3.16	41.70	53.14
8879	Subsoil of 8878.....	Black clay, 12 to 36 inches.	1.75	2.56	7.26	6.00	17.24	18.04	23.88	25.02
8877	Subsoil of 8876.....	Heavy clay, 12 to 36 inches.	2.55	.00	.34	.50	2.66	8.52	34.36	53.62

The following sample contained more than one-half per cent of calcium carbonate ($CaCO_3$): No. 8879, 0.75 per cent.

HARDPAN.

The existence of hardpan in the soils of an area is often a serious problem. Frequently this occurs in the subsoils in extensive sheets, forming an impassable barrier to both the upward and the downward movement of the waters, as well as to the roots of plants.

In the San Jose area, however, hardpan occurs only in a few local spots, particularly along the southwestern margin of the area surveyed. It usually may be seen in stream cuts, where it is exposed as irregular, interlacing, or lenticular beds, consisting of coarse river sands, water-worn pebbles, and cobbles cemented with lime carbonate. In only a few localities do these beds approach close to the surface, or occur in areas so extensive as greatly to influence the growth of crops.

WATER SUPPLY FOR IRRIGATION.

In nearly all the coastal and interior valleys of the southern half of the State of California the average annual rainfall is very small. Not only is the normal supply small, but the supply from season to season is uncertain. Years of more than ordinary precipitation sometimes occur, preceded or followed by those of severe and persistent drought.

In the Santa Clara Valley the amount of moisture supplied by the rainfall is not only greater, but of more stable and less uncertain character than in most of the other valleys. By the prevailing system of thorough cultivation of the lands devoted to intensive agricultural and horticultural pursuits much of the precipitated water is preserved in the soil and made to serve its mission in supplying crops. Upon much of the lands of the valley devoted to grain and hay farming, and of the elevated lands of the foothills and mountain slopes given to the growing of hay, grain, grapes, and fruits, little or no irrigation is practiced. Indeed, in the area surveyed, irrigation was at one time considered unnecessary. The average annual rainfall is, however, insufficient for the maximum growth of crops, and in all seasons the artificial application of water is beneficial, greatly augmenting the yields of fruit, grains, or other crops. With few exceptions, the growing of fruit or vegetables in the valley is now hardly considered feasible unless ample facilities for irrigation are at hand.

The waters used for irrigation purposes in this area are supplied from two sources, viz, the streams and the artesian basins. Only a few small tracts fortunately situated near stream courses are irrigated by water from this source. A great variation in the water supply, resulting from the difference in the wet and dry seasons, necessarily occurs. Irrigation by stream water can take place only during the months of the rainy season and spring, with the exception of the use of very small quantities of water about the bases of the mountains supplied by minor canyon streams fed by mountain springs.

In the valley there are a few small private canals supplied by the Coyote, Guadalupe, and other larger creeks during the winter and spring. They usually discharge not more than a few cubic feet per second and cover only small areas. The most of the tracts so irrigated lie in the southern part and along the western margin of the area. The proportion of soluble mineral matter or alkali salts in these waters is subject to considerable fluctuation with the flow of the stream. At no time, however, during the period at which water is available for irrigation is the content dangerously high.

Considerable confusion usually prevails regarding the terms artesian and underground waters and artesian and flowing wells. Strictly speaking, artesian water consists of underground water confined between relatively impervious layers of rock or earth and having its

source at a higher elevation. Hence the water is under a head of pressure, and rises to a height corresponding to the pressure when the confined strata are tapped. The pressure may or may not be great enough to cause the water to rise to the surface. Hence an artesian supply may or may not produce a flowing well. Many artesian wells exist in the Santa Clara Valley, and nearly all irrigating waters are derived from this source. Only in the lower portions of the valley, however, is the pressure great enough to cause the water to reach the surface of the land.

The flowing wells of the San Jose area lie generally at an elevation of considerably less than 100 feet. They are most frequently seen in the district lying between San Jose, Santa Clara, and Mountainview, and the Bay of San Francisco. They are usually of moderate flow, but capable of irrigating a considerable area of land. With the increase in the number of these wells and the installation of large pumping plants in the higher elevations of the valley the pressure has gradually decreased. Some of these wells now produce but little flow and are failing rapidly. This is, however, doubtless due in part to faulty construction, insufficient casing, and consequent choking of the outlet.

The wells vary in depth from 150 to 400 feet, the water being encountered in strata of coarse sands and gravel occurring between strata of heavy clay. The character of the water is excellent, being free from any organic matter and carrying only very small proportions of mineral salts.

But comparatively little of the fruit land is irrigated from this source, the wells being confined for the most part to the bodies of heavy adobe lands and heavier sediments of the lower valley. The supply for the most part is utilized in the irrigation of vegetables, small tracts of fruit, and general farm crops, and as a supply for stock. Upon much of this land water already approaches close to the surface, and the question of the water supply is a less serious one than upon the more elevated tracts of more pervious soil, having greater importance in fruit growing.

When the pressure upon the underground water is insufficient to produce a flowing well, recourse is had to pumping. By far the larger and more important districts of the valley are irrigated in this manner. The waters of both surface and artesian wells are used for this purpose, the latter greatly predominating.

The waters of surface wells are obtained from the beds of water-bearing gravels first encountered. The depth varies greatly, depending upon surface topography and position of the water-bearing strata. The water rises in the wells but little if any above its source. There is generally a good flow, some wells from 50 to 70 feet deep supplying plants capable of irrigating about 1 acre per day. The water is

usually of excellent character, carrying only from 20 to 40 parts solid matter to 100,000 parts of water. The water supply of the artesian wells is generally obtained from the second stratum of water-bearing gravels, the depth ranging from 150 to 450 feet. A more certain and abundant supply is obtained than with the wells of less depth. The water is of excellent character, the percentage of soluble salts being usually somewhat less than with the shallower wells. The pumping plants are owned privately, the water being sometimes sold to owners of neighboring tracts and distributed through extensive systems of underground pipe lines.

Various kinds of plants, operated by steam, gasoline, or electricity, are in use. With the steam plants using coal or wood for fuel, refuse cuttings from vines and trees may be utilized as fuel. This must, however, form an inconsiderable proportion of the total fuel supply. Crude oil is now used extensively under the boilers of the steam plants at a considerable saving in the cost of operation. Most of the smaller plants, and some of the larger, are equipped with gasoline engines in which the commercial engine distillate and lighter petroleum oils are used. While this involves less labor than the use of steam, the attention of an attendant is required.

In the long-distance transmission of electric power California has made great progress, the cities about the bay, including the towns of the San Jose area, being supplied from currents generated in the Sierra Nevada Mountains. This has given rise to the use of electric power for use in pumping irrigation water. A number of pumping plants operated by electricity from feeders radiating from main lines are in operation. These plants are generally giving good satisfaction in economy of cost of power consumed, uniformity of power, and simplicity of operation. When once adjusted these plants require little or no attention while in operation.

The cost of irrigating varies greatly, being subject to the depth of wells, character of power used, capacity of plants, etc. The first cost of the gasoline and electric plants is generally somewhat less than for those operated by steam. Gasoline-operated pumps are usually the most economical for small tracts. For those of moderate or larger capacity, electric power is proving most economical, the rates charged decreasing with the increase in amount of power used. Water is sold at rates which make the annual cost of irrigating from $2 to $6 an acre, depending upon the quantity of water used.

In a few cases plants are situated by stream channels, the water being derived from the underflow or pumped from the stream bed. Upon the lower lands near the bay the brackish tide water backs up into the streams for several miles. Plants drawing their supply from the open water in this portion of the area may irrigate with safety at ebb tide. During times of high tides, however, the water at one plant,

occur, however, along rock exposures, as, for instance, those at Alum Rock Springs, upon the east side of the valley, which are heavily charged with soda, sulphur, and other common minerals. Waters from a few of the wells, as previously noted, lying in the depression east of San Jose, carry large quantities of the common alkali salts. In the case of one such well, about 35 feet in depth and lying about 2 miles east of San Jose, analysis of the water reveals the presence of over 700 parts solid matter per 100,000 water. In the waters examined, sodium chloride and sulphates of magnesium and sodium seem to be the prevailing salts. The presence of such large quantities of these salts in the waters of the surface wells in this section indicates the presence of extremely large quantities of the salts in the subsoils.

In irrigated districts the accumulation of seepage water is of frequent occurrence and constitutes a well-founded cause for grave alarm. The cause lies usually in the irrigation of soils of loose texture and open structure, the use of immoderate quantities of water, or the loss of water by seepage from canals, reservoirs, and water courses traversing soils of loose, open character. In this manner enormous quantities of water often go to waste, and passing through miles of sandy porous subsoils appear as seepage springs along terrace margins, or form lakes, bogs, or marshes upon heavy low-lying lands or depressions. It is thus that the heavier and more impervious soils of depressions and lower areas, often the most valuable lands, suffer most. These waters in percolating through the soil and subsoil come in contact with and readily dissolve the soluble alkali salts with which the soils may be impregnated. Thus in a district in which the common alkali salts are of frequent occurrence the seepage waters become of constantly increasing concentration, depending upon the distance traveled underground and the alkali content of the soils, subsoils, or rock through which they may have percolated. When by virtue of the subsoils being saturated, that is, completely filled with the excess drainage or seepage waters, the water table or zone of free water approaches the surface, danger threatens. When so close to the soil surface that a zone of moist soil extends as an uninterrupted connection between the soil surface and the zone of saturation, ideal conditions for the evaporation of large amounts of water from the surface supplied by the excess waters of the subsoil are established. In this manner mineral salts held in solution in the soil waters are carried to the surface, where the solution becomes subject to rapid concentration, until the salts are finally crystallized out and impregnate the soils or are deposited as alkali crusts.

The accumulation of alkali salts, while in itself so serious a result as to ruin the land, is, however, not the only evil effect experienced. With the approach of the water table toward the surface the root zone or feeding ground of all but plants of more or less aquatic nature is

having its source of water supply in the bed of Guadalupe Creek, near Agnew, was observed to carry over 700 parts salts per 100,000 of water. Irrigation was, however, here practiced only at ebb tide, with no evidence of harmful results.

UNDERGROUND AND SEEPAGE WATERS.

Underground waters have their source in rains and melting snows. Impelled by the force of gravity this water finds its way downward through the pores and interstices of the soil and rocks until it meets with an impervious layer or reaches the point at which the pores or capillary spaces are completely filled.

This point of saturation is designated by the term water table. Here the downward or gravity movement terminates, and under favorable conditions drainage takes place by lateral movement to lower levels. Water may escape through crevices or along exposures of pervious strata, giving rise to springs, lakes, or streams. Wide fluctuation in the position of the water table may occur, depending upon the amount of rainfall, drainage, soil texture and structure, etc.

Working in the opposite or upward direction are the capillary forces of the soil by which quantities of water are transferred from below to the soil surface. These forces operate only after gravity movement has ceased and the soil water in excess of that held by capillary forces in the small capillary cavities has drained away through the larger openings. In soils of favorable texture and structure large quantities of moisture may thus be retained in the capillary spaces. As evaporation at the soil surface or within the soil takes place, an upward movement, actuated by capillary forces, begins, by which the moisture retained by the subsoil is supplied to the soil surface. Unless the soil surface be well cultivated and a condition of fine tilth be maintained the greater proportion of this supply will be lost through surface evaporation. A mulch of loose fine earth checks this loss by interrupting the capillary passages near the surface, and renders this supply of moisture of great value to crops in time of drought. In these capillary properties soils of fine texture excel, provided proper surface cultivation is maintained. The soils in the San Jose area as a rule possess marked capillary power, which, together with deep and frequent and thorough cultivation, greatly enhances their value.

The character of underground waters depends upon the character and amount of organic and mineral matter with which they have come in contact during their passage through the earth. The character of the underground waters of an area may thus be taken to indicate the amount and character of soluble mineral salts of the subsoils through which the water passes. In the San Jose area the underground waters are usually relatively pure and free from alkali salts in objectionable quantities. Alkali and mineral springs sometimes

restricted. In many cases field crops are destroyed by reason of water-logged soils preventing proper aeration of the soil, retarding natural chemical and physical processes leading to decomposition of inert mineral and organic material, checking the development of bacterial life leading to the formation of valuable nitrogen-bearing compounds, and actually starving or drowning the plants. The formation of impassable and unhealthful disease and insect-breeding bogs, swamps, and marshes, covering areas of former cultivable land, is also one of the most obvious and first-noted effects of seepage.

In the Santa Clara Valley the higher elevations are generally covered by loose, porous soils through which water readily finds its way. Along the axis of the valley and in its lower part the soils are of a dense, heavy nature, allowing the water to percolate slowly. Natural topographic conditions hence favor the collection of seepage waters in dangerous quantities in the valley bottom. This has to a certain extent taken place throughout the part of the valley over which the presence of alkali salts is indicated upon the alkali map. The area is, however, not heavily irrigated. The lack of an abundant water supply, obtainable without the expense incident to pumping, places a check upon the use of excessive quantities of water for irrigation, so common a circumstance in districts of cheap and abundant water supply. This, with the prevailing system of an intelligent application of water and economy in its transmission, greatly reduces the danger. Although throughout the main valley trough and the lower northern part of the area the water table approaches close to the surface, natural drainage waters and topographic conditions are responsible for this rather than overirrigation.

For these conditions of water-logged soils, whether resulting from waste waters from irrigation or from natural causes, a thorough drainage of the land offers the sole remedy. In general, a system of underdrainage by tiling is preferred, since it offers no obstacle to cultivation, is not choked by wind-blown weeds, and is in the end cheaper and more efficient. Laterals of tile may, if necessary, discharge into central open ditches of larger dimensions. The distance between lines of laterals should depend upon the porosity of the soil, and the tile should be laid deep enough to keep the water table below the danger line, usually not less than 6 feet below the surface. Such systems of drainage have proved thoroughly effective in removing excess seepage waters, changing swampy, water-logged areas into lands capable of being cultivated with profit, and in preventing further accumulation of the injurious alkali salts. Drainage of lands is, in the Santa Clara Valley, no novel or untried expedient. Many of the lower valley depressions and much of the area of heavier soils in the vicinity of Santa Clara, Agnew, and Milpitas, and about the swamp lands of the bay, have been reclaimed from a boggy, water-logged condition and

rendered more productive in this manner. The extension of the drainage systems throughout the portions of the area over which an accumulation of alkali salts appears and over the lower tracts adjacent to the tidal marshes about the bay is desirable.

ALKALI IN SOILS.

Although the alkali conditions of the San Jose area are much less serious than in many of the coast and interior valleys of the State, about one-fourth of the total area of soils mapped was found to contain objectionable amounts of the soluble alkali salts within 6 feet of the surface. Of this area, however, the large proportion consists of the untillable salt-marsh lands about the bay. In the agricultural lands of the valley several relatively small alkaline areas occur. One of these touches upon the southern boundary near Edenvale; another covers the low depressions situated in the valley floor east of San Jose, while between San Jose and San Francisco Bay the lands of the valley trough are usually rather poorly drained and carry a small percentage of the common alkali salts. The tidal marshes of the bay are of course extremely salty, and a narrow zone of alkali land, surrounding and resulting from the marshes, encroaches upon the cultivated lands of the valley.

While over large areas the soils carry from 0.20 to 0.40 per cent of soluble salts to the depth of 6 feet, in only a few cases is this limit exceeded upon the agricultural lands of the valley. While this quantity of alkali salts is objectionable and dangerous if allowed to become concentrated in the surface soil, even in that event it by no means takes away the value of the land for some agricultural purposes. Some of the hardier fruits, especially pears, can be grown and often yield abundantly under intelligent cultivation. Onions, asparagus, and sugar beets will resist this amount of the soluble salts if the ground be first well prepared for the seed bed and the salts be kept away from the tender young roots by frequent irrigation and cultivation. Barley for grain or hay may be grown successfully, if once the seed be germinated and the young seedlings well established. Wheat and corn are somewhat less resistant, although sorghum will endure much larger quantities of the salts. Lands ranging from 0.40 to 0.60 per cent are generally devoted to pasture, although in other areas sorghum, sugar beets, and alfalfa have been found to produce partial or full crops upon lands of this character. The soils and muds of the tidal marshes carry over 3 per cent of salts of marine origin, while narrow bordering zones of soils are of the intermediate grades.

In the soils of the San Jose area sodium sulphate and sodium chloride seem to be the prevailing salts. Sodium bicarbonate and the sulphate of magnesium also occur to some extent. Sodium chloride forms the

prevailing salt in the part of the area influenced by marine deposition. The extremely injurious black alkali, or sodium carbonate, was detected in a few of the underground waters, but is of rare occurrence in this area, and with due attention to the drainage of soils need not be feared.

Since the alkali salts of the soil are readily carried in solution, their distribution in the soil is determined largely by the movement of the soil waters. Heavy rains, as well as surface irrigation, soaking downward into the soil, dissolve and carry the salts downward by gravity to the limit of penetration. If the surface flooding be copious and gravity movement be aided by natural or artificial underdrainage, large quantities of the alkali salts may be permanently removed. With the cessation of the downward gravity movement upward capillary movement, induced by surface evaporation, begins. The dissolved salts are now carried upward in solution and deposited upon the surface as a crust as the water evaporates. Owing to complex capillary forces, however, the soluble salts tend to cling to the surface of the finer soil particles, hence movement of the salts downward with the gravity waters through the larger openings takes place less readily than the upward movement with the capillary waters taking place through the more minute openings. Hence the alkali salts tend to collect at the surface or within the root zone of crops. In the case of heavily impregnated subsoils shallow-rooted crops may be grown, provided the water table be kept at the proper depth below the surface and the upward movement of the salts by evaporation be checked by frequent and thorough cultivation. In the case of large quantities of alkali salts in the immediate surface soil, with subsoils free from alkali, deep-rooted crops may be successfully grown. Heavy flooding before seeding or the planting of crops in deep furrows is sometimes resorted to in such cases.

The frequency and character of cultivation and irrigation and the conditions of soil drainage are thus of great importance in determining alkali distribution and agricultural success. In the San Jose area the salts are generally quite evenly distributed throughout the surface 6 feet. In the case of the lower lands in the vicinity of Agnew, however, where the water table more closely approaches the surface, the salt concentration is localized in the upper portion of the section.

RECLAMATION OF SWAMP AND ALKALI LANDS.

In the case of both swamp and alkali lands in irrigated sections the conditions can generally be traced to the accumulations of excess seepage and drainage waters, and the first step is to provide means for removing the excess and for keeping the water table at a safe depth below the surface. The next step is to supplement this by the proper methods of cultivation, irrigation, and cropping.

Various means for the reclamation of alkali lands have been proposed, viz, scraping the surface, growing alkali-resistant and salt-absorbing plants, the application of chemical correctives, and drainage. Of these, however, only the last-named method effectively removes the cause and accomplishes complete reclamation. In the case of the accumulation of black alkali, the application of gypsum to the surface is beneficial, since a chemical reaction takes place by which the sodium carbonate is converted into the white alkali or sodium sulphate, which is not only much less injurious but also more readily leached from the soil. Since black alkali does not occur in dangerous quantities in the San Jose area, however, the method of drainage, supplemented by careful and thorough cultivation and irrigation, is all that need be considered.

The subject of drainage of soils in the removal of excess water has already been discussed. The efficiency of this method in the reclamation of alkali lands has already been proved. The use of excessive quantities of irrigating waters is to be avoided, although occasional heavy flooding, when supplemented by underdrainage, is beneficial in leaching the salts from the surface, which in this way are carried away in the drainage waters. The growing as soon as possible of some cultivated alkali-resistant crop, such as sugar beets or sorghum, is recommended. Between periods of flooding the surface should be kept in a condition of fine tilth by cultivation, the mulch of loose earth maintained by this method retarding evaporation and the upward capillary movement of the salt solutions from below.

In the Santa Clara Valley the work of assisting the natural drainage, the maintenance of careful and thorough cultivation throughout the dry season, and the utilization of alkali lands for the growing of alkali-resistant crops is of more than usual importance, since the obtaining of an adequate water supply for frequent heavy flooding by pumping or from flowing wells is here somewhat uncertain and expensive. Fortunately much has already been done in the way of soil drainage, and with the extension of the drainage systems, economy in the use of water upon the elevated soils of loose texture, and the practice of thorough intensive cultivation, the winter rains will suffice to aid to a considerable extent in leaching the salts from the surface, and the processes of nature may be led to effect a gradual reclamation.

Upon the low, heavily impregnated lands in the vicinity of the tidal marshes the erection of dikes and the shallow cultivation of the surface may render portions of use for grazing purposes or for the growing of shallow-rooted crops. The reclamation of the tidal marshes is, however, a too expensive and difficult matter to be considered, with land values at their present level.

AGRICULTURAL METHODS.

Agricultural practice as carried on in this area is generally of an intensive character. Modern methods are employed, and the work of orchard and farm is usually conducted in a systematic and business like manner. The evolution from an extensive to an intensive system of agriculture is still taking place, and smaller, well-cultivated orchards and vineyards are still replacing the larger pasture and grain fields, greatly to the advantage of this important fruit-growing section.

A keen interest is taken in the development of specialized lines of horticulture and agriculture, and organizations for mutual benefit in the discussion and adoption of scientific methods of farming and fruit growing and of disposing of the crops are maintained.

Plowing, harrowing, and general preparation of the land are usually of a thorough character. This is true especially in the intensively cultivated fruit-growing districts. Before irrigation the clods are crushed and the surface pulverized and carefully leveled. Subsequent cultivation keeps the orchards free from weeds and retains the moisture of the subsoils for the use of growing trees and developing fruit. The importance of deep, thorough, and frequent cultivation in conserving soil moisture seems to be understood and made to render valuable assistance during the dry season. Upon the less intensively cultivated tracts—grain and hay lands, for example—soil preparation and subsequent cultivation are more hasty and incomplete.

The use of commercial fertilizers is very limited, but in the fruit lands is in some cases attended with good results. Crop rotation and the application of green and stable manures should be practiced to a greater extent than at present. Modern methods in the harvesting, packing, and shipping of fruits obtain, a large part of the output being handled through fruit growers' organizations of a more or less cooperative character.

In the practice of irrigation water is often carried long distances through wooden or iron pipes, and economy in its application to the soil prevails. Water is applied by the furrow method or by the flooding system with small rectangular or contour checks. The frequency and time of irrigation depend largely upon the character of the season and crop, and the nature of the soil. The first application is usually made during the month of February or during the early spring, followed later by one or two others, if necessary. Prunes generally require a somewhat more abundant water supply than the other fruits of the section. The fruit is, however, allowed to ripen with the soil in a rather dry condition, since too much moisture at this time tends to the formation of cracks in the fruit. For prune culture the land selected should be plowed to the depth of 10 or 12 inches, thoroughly harrowed, and rolled or leveled. The trees are set about 25 feet apart

in holes dug about 2 feet deep and nearly the same in diameter, the labor of preparing the ground and setting and staking the trees costing about $10 or $12 an acre.

In the selection of nursery stock considerable discretion is required, the prune being grown only by grafting upon peach, almond, apricot, or plum roots, according to the nature of the soil and facilities for irrigation. Nursery stock grown without the aid of irrigation is preferred, the trees costing from 12 to 15 cents each. Upon elevated gravelly soils, capable of little or no irrigation, the deep-rooted almond root has proven most profitable. Upon the sandy or silty loams, where irrigation can be carried on, the spreading-peach root is in considerable demand, producing earlier bearing trees than any of the other graftings. The trees are, however, shorter lived and the fruit somewhat inferior to that produced upon the almond root. The apricot produces an earlier bearing, more vigorous tree with excellent quality of fruit, but difficulty is often experienced in obtaining a graft of firm and complete union, the trees sometimes breaking over when loaded with fruit and not well supported by props. Myrobolan plum roots are in demand for planting upon low and wet areas of heavy silt loam and the adobes, where trees from the peach, almond, and apricot stocks will not make satisfactory growth.

With proper cultivation and pruning the trees come into bearing at from five to seven years. When ripe the fruit falls to the ground, is gathered, graded according to size, dipped in a solution of hot lye, placed upon trays, and exposed to several days of sunshine. The dried fruit is generally shipped in boxes holding 25 or 50 pounds each.

Peaches and apricots come into full bearing at from four to six years. The trees are pruned in the fall after the removal of the fruit, considerably more cutting being required than in case of the prune. For best results in size and quality the fruit is thinned by hand. For drying the crop is harvested while still firm, cut into halves with pits removed, and submitted to sulphur fumes in air-tight vaults or houses, for the purpose of preserving natural color and destroying insect germs. The fruit is then finally cured in the open air. Pear trees require little pruning. The fruit is sent to market canned or green. Cherries are in good demand, the fruit being shipped green or canned. The Black Tartarian and the Royal Anne are the most popular varieties.

AGRICULTURAL CONDITIONS.

In general, the farming class is prosperous and contented. A wide variation in classes, races, and religious sects exists. There is a large admixture of the Latin races of the more intelligent and industrious class. This cosmopolitan phase of life has given rise to freedom of thought and to the growth of excellent educational systems.

The public school system is thorough and modern. Opportunities for higher education are afforded by several high schools, colleges, and universities, the most notable being the Leland Stanford Junior University at Paloalto, the most richly endowed educational institution in America. Mutual improvement, literary, agricultural, and commercial clubs are numerous.

In the most highly developed and intensively cultivated fruit sections fine private residences, often of quite pretentious character, are found. Rural mail routes with daily delivery cover a great part of the area, while telephone service places the orchardist or farmer in immediate communication with his markets and neighbors. These conditions, with small farms or orchard tracts, do away with much of the isolation and lack of sociability of ordinary farm life. Many beautiful country houses belonging to wealthy residents of San Francisco and other parts of the West and East are also to be seen throughout the area, but especially in the vicinity of Paloalto, Fair Oaks, and Menlo Park.

In the fruit districts the farms are generally small, often consisting of only 15 or 20 acres or even less. Tracts of this size pay well and call for the employment of but little outside labor. Large fruit ranches also occur, giving employment to large numbers of laborers. Owners of small or new tracts thus find employment during periods of unproductive development. A few of the grain, hay, and stock ranches are quite extensive but well managed.

No unusual amount of incumbrances is carried by the farms and orchards of the area, which are, for the most part, well farmed by the individual owners. Orchard tracts in full bearing, with good buildings, bring from $400 or $500 an acre up, according to location, distance from towns, and water supply. Unimproved lands, suitable for prunes, peaches, pears, apricots, small fruits, cherries, apples, etc., bring from $150 to $250 an acre. Vineyard lands can generally be obtained more cheaply. Tax rates are not unusually high, considering the expense of construction of country roads, bridges, public buildings, and other State and county demands.

Farm labor commands a fair price and is in good demand, especially during the fruit harvesting, packing, and shipping seasons. Much of the labor of packing, drying, canning, and shipping is done by women and children. No idleness need occur at this period of the year, as the demand for labor, both for the heavier and lighter kinds of work, usually greatly exceeds the supply. Considerable labor on the truck farms and in the orchards is performed by Japanese and Chinese, but not to the exclusion or injury of industrious whites. The labor employed, under careful management, becomes of marked efficiency.

The crops produced vary widely in character and value. The area is, however, of world-wide reputation as a center of the prune and other dried and canned fruit industries. Several of the largest can-

ning, drying, and packing establishments known are located here. Of prunes, the French, Imperial, and Silver varieties are most grown. Good average yields net a profit of over $100 an acre, many orchards greatly exceeding this return. Peaches, apricots, plums, and pears do as well, although grown to less extent. Cherries sometimes net $200 or $300 an acre. Grapes are grown chiefly for wine, yielding 4 or 5 tons per acre. The cost of bringing a vineyard into bearing is generally somewhat less than $100 an acre.

Truck farming and the growing of small fruits, consisting of strawberries, blackberries, and loganberries, are assuming a rapidly increasing importance. Suitable land may be obtained for $150 an acre where irrigation can be carried on from flowing artesian wells. The growing of apples is attended with but little expense for care, and can be made a lucrative industry on the soils of this area. Walnuts, almonds, and olives are grown to a considerable extent. Asparagus and tomatoes yield handsome returns and are important and growing lines of intensive farming.

In addition to the fruit and truck interests, a large acreage is devoted to the growing of wheat and barley for grain, while large areas of these crops are cut green and cured as hay. Upon low areas, where danger exists from killing frosts, this proves a profitable practice. Seed growing is an established industry of world-wide reputation and is capable of further extension—onion, sweet pea, lettuce, and other garden and flower seeds being produced. Dairy and poultry interests pay well owing to limited supply of these products and good near-by markets, while extensive stock farms, one of which has produced one of the most famous strains of trotting and pacing horses ever bred in America, lie within the area.

Considerable damage has in the past been done by vine diseases and insects, but this is now largely avoided by a more careful selection of location and the planting of disease-resistant stock. Other insects and fungus or bacterial diseases of orchards and vines are not especially prevalent, and are controlled by spraying, fumigating, and other vigorous methods of combating these pests. The dreaded San Jose scale, probably of Chinese importation, which first made its appearance in this country in this valley, is now no longer found, except in isolated and rare cases. No unusually noxious or persistent weeds occur.

The cities of San Jose, Santa Clara, Palo Alto, and Redwood City, with the small towns of the area, offer excellent local markets and splendid opportunities for manufacturing and commercial interests. Lumber mills, tanneries, brick works, canning and drying plants, and other enterprises furnish labor to thousands and control an enormous output. The cities and towns are usually neat, maintain good public buildings, and, with surrounding points of interest, are attracting many tourists and wealthy seekers of summer and country homes.

Three lines of steam railway, with quick and frequent suburban service, place the area in close communication with San Francisco and the surrounding towns of the Bay, while transcontinental freight and passenger traffic by way of Los Angeles and the coast division of the Southern Pacific Railway passes through the valley. As all lines of steam railway are, however, operated by one company, the cheapening effects of competition are not enjoyed. Electric railways for freight and passenger service are rapidly being extended throughout the area, and, with the construction of one proposed line connecting Alviso with shipping points, a cheap outlet for freight by way of bay vessels will be opened. Considerable grain, hay, and bulky products from the country adjacent to Alviso, Redwood City, and other bay points are now shipped in this manner.

The condition of the country highways is excellent, the main thoroughfares being macadamized and treated with crude oil, which greatly improves their condition, or kept well sprinkled throughout the dry season. In addition to local markets, San Francisco, only 50 miles from San Jose, furnishes excellent opportunities for the disposal of fruits, trucking produce, poultry, milk, butter, cheese, and other agricultural products. Shipments are made to eastern points upon a par in freight rates with those from San Francisco.

In the way of natural attractions and possibilities in intensive horticultural and agricultural pursuits the San Jose area offers excellent advantages to the home seeker of moderate means and thrifty and industrious habits, while those of little or no means may readily obtain labor of their more fortunate neighbors, and by careful investment of earnings themselves become independent.

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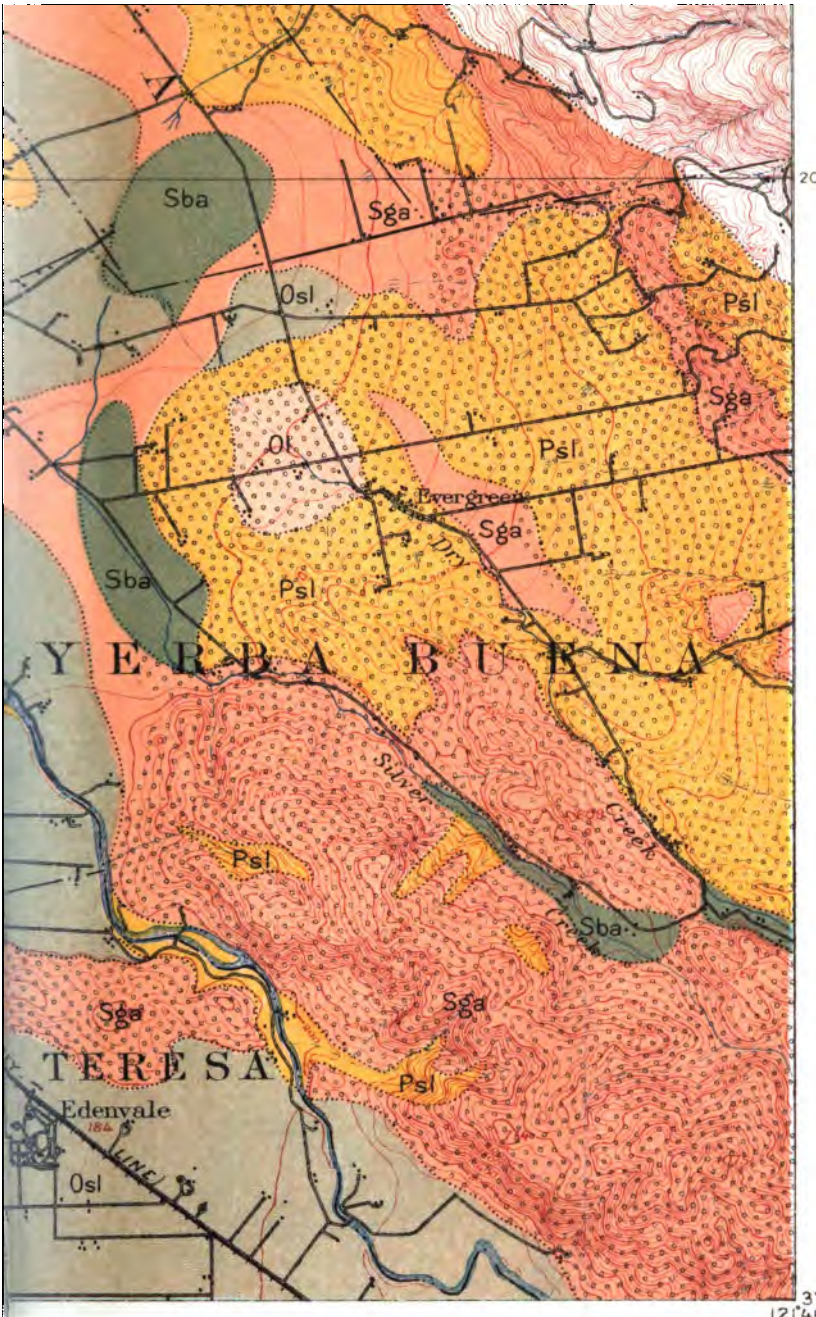

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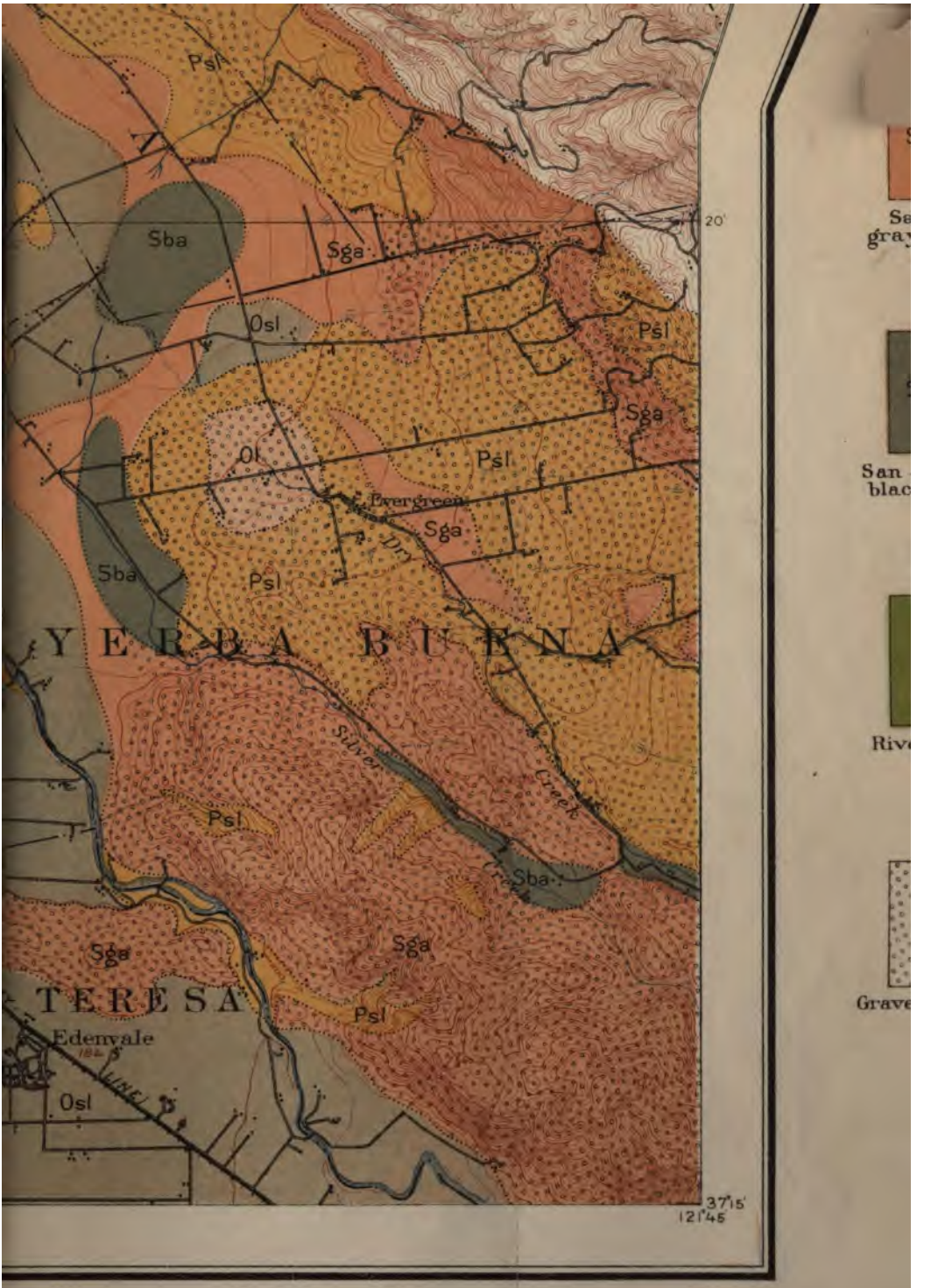

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